

Pilot study results for a novel system of networked, low cost personal air quality monitors

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Background and aims: This project uses the latest in personal air quality monitoring to understand the links between location, activity choices and exposure to air pollutants. The aim of the initial user study is to demonstrate the utility of this novel real-time exposure characterization system at developing and comparing distributions of exposure for a small population of students over the course of multiple months.

Methods: The individual personal monitors, referred to as E-pods (exposure-pods), communicate with Android mobile phones via Bluetooth, providing geo-tagged real-time personal pollutant levels and activity logs. We have incorporated low cost sensors, including carbon dioxide, and metal oxide sensors to monitor volatile organic compounds, carbon monoxide, ozone, and nitrogen dioxide. A critical component of the exposure characterization system is calibration; as such details will be presented.

Users and observers may view the exposure, location, and activity data on a web-based GIS interface with built-in analysis tools. In order to track indoor location, a novel WiFi-based room localization system has been built into the mobile phone application.

Results: Calibrations have shown high sensitivity and fast responses for all the sensors. Uncertainty estimates are near $\pm 5\%$ for the metal oxide sensors and near $\pm 2\%$ for the carbon dioxide sensors. Pilot study results are presented from an initial user-deployment of five people. Grouping pollutants by locations and activities showed statistically significant differences in concentrations. Room localization has proven beneficial in this regard.

Conclusions: The personal exposure characterization results are promising and should be of interest to health researchers. Additionally, users and community members have greater awareness and interest in air quality after using the device. There are many opportunities in this area, though the sensors used require significant time and effort for calibration.